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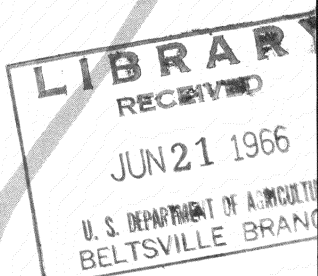
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SUGARBEET INSECTS

HOW TO CONTROL THEM



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SUGARBEET INSECTS:

How To Control Them

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Insects attack sugarbeets from planting time to harvest. Some feed on the seed and roots; some feed on the leaves; others suck juice from the plant.

Most of these insects may be controlled through changes in cultural

practices or by using insecticide. Because no one insecticide will control all the insects, you first must identify the insect damaging your sugarbeets. Injury may be confined to roots, or to crowns and foliage, or it may be hard to detect.

INJURY CONFINED TO ROOTS, AND PESTS RESPONSIBLE

Nature of injury	Name of pest and page on which it is discussed
Beets are retarded, off-color, light or yellowish green.	
Roots contain a moldlike substance that covers yellow-white wingless aphids up to $\frac{1}{8}$ inch long and a smaller number of darker, winged forms. They suck sap from beet roots.	Sugarbeet root aphid. See p. 14.
Beet stands are reduced; plants are stunted, wilting, and dying.	
Around roots are white maggots about $\frac{1}{4}$ inch long. They have no legs, eyes, or distinct head. They taper like a horn and come to a sharp point at the front. Beet roots may be riddled with burrows and surface scars.	Sugarbeet root maggot. See p. 6.
Seed is destroyed during germination; taproots of small plants are cut off; or roots of older beets are badly scarred by slender, tough, smooth, wirelike worms varying from white or yellowish to dark brown, and ranging from $\frac{1}{16}$ to $1\frac{1}{2}$ inches in length.	Wireworms. See p. 6.
Tap roots of small beets are cut off; larger beets have big side holes. Damage is by soft, robust, dirty-white to grayish, U-shaped grubs that are up to $1\frac{1}{2}$ inches long. Grubs have 6 legs, shiny-brown heads, and blackish abdomens or hind parts.	White grubs. See p. 7.
Plants are stunted or dying, small roots are eaten off by active, small, fragile, whitish, centipedelike creatures. They are up to $\frac{1}{4}$ inch long and have 6 to 12 or more pairs of legs.	Symphylans. See p. 8.

INJURY CONFINED TO CROWNS AND FOLIAGE, AND PESTS RESPONSIBLE

Nature of injury	Name of pest and page on which it is discussed
Cotyledon and small beets are badly eaten or destroyed.	
Cotyledon or first true leaves have small shot holes. Some beets may be completely eaten by tiny, brown, shiny-black, or striped jumping beetles that are up to $\frac{1}{2}$ inch long.	Flea beetles. See p. 9.
Wilted sugarbeet tops near thinning time may be partially or completely cut off at the crown by smooth, hairless, fat, soft-bodied, greasy-looking worms. They are $\frac{1}{2}$ to 2 inches long and are found near the freshly cut beets just under the soil surface.	Cutworms. See p. 9.
Dirty-white larvae, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, have a distinct greenish tinge. They are found just under soil surface in silken tubes 2 to 6 inches long radiating out from the crown of wilted or cutoff beets.	Sugarbeet crown borer. See p. 9.
From thinning time to late season, beet foliage is eaten away, skeletonized, or mined.	
Leaves skeletonized or ragged and webbed by active olive-green worms that have light and dark longitudinal stripes running the length of the body. They are $\frac{1}{2}$ to $1\frac{1}{2}$ inches long. When disturbed, they drop and hang from a silk thread or retreat into silken tunnels.	Beet webworm. See p. 10.
The same type of injury as for the beet webworm is caused by pale greenish-yellow to dark-yellow larvae. They are slightly hairy, have numerous black dots, and are a little larger than the beet webworm.	Garden webworm. See p. 11.
Blisterlike or blasted spots and irregular tunnels between the leaf surfaces are made by maggots that eat the interior of the leaf. They are $\frac{1}{2}$ inch long.	Spinach leaf miner. See p. 11.
Foliage eaten by thick-bodied caterpillars that are $1\frac{1}{2}$ inches long. They crawl over the ground in masses and consume all green plants in their path.	Armyworms. See p. 12.
Beets bordering alfalfa are eaten by light-green, dark-olive-green, or pale-greenish-brown larvae. They are up to $1\frac{1}{2}$ inches long, taper toward the head, and move in a looping manner.	Alfalfa looper. See p. 12.
Beet foliage is eaten in late season by large, slender, jumping or flying insects, 1 to 2 inches long. They usually move into the beets when other crops are harvested.	Grasshoppers. See p. 12.
Beet leaves are eaten by ash-gray, black, marginated, spotted, or striped slender beetles. They are $\frac{1}{2}$ to over 1 inch long, 4 times as long as wide, and have conspicuous heads and necks, long legs, and antennae.	Blister beetles. See p. 13.

INJURY CONFINED TO CROWNS AND FOLIAGE, AND PESTS RESPONSIBLE—Continued

Nature of injury	Name of pest and page on which it is discussed
<p>From thinning time to late season, beet foliage is eaten away, skeletonized, or mined.—Continued</p> <p>Foliage is eaten by dull-black, oblong-oval-shaped beetles, $\frac{1}{2}$ inch long, and their shiny-black, flat, wedge-shaped young.</p> <p>Beets are damaged in late season by large caterpillars that are up to 2 inches long. They are covered by long reddish-brown or black hairs and have sides distinctly marked with yellowish spots.</p>	<p>Carion beetles. See p. 13.</p> <p>Salt-marsh caterpillars. See p. 14.</p>

INJURY HARD TO DETECT, AND PESTS RESPONSIBLE

Description of pest	Name of pest and page on which it is discussed
<p>Damage caused by sucking insects. Crop should be watched for the following insects to prevent damage before symptoms show.</p> <p>Shy, angular, flattish, pale-green to reddish- or dark-brown sucking bugs, $\frac{1}{4}$ inch long, are difficult to see on the green plants. Sometimes leaves are wilted.</p> <p>Large numbers of a grayish-brown, narrow-bodied insect, $\frac{1}{8}$ inch long, that has transparent wings lying flat on its back, are sometimes clustered on the plants.</p> <p>Small, greenish or yellowish, slender, wedge-shaped, active jumping and flying insects, less than $\frac{1}{8}$ inch long, cause leaves to curl from virus they transmit.</p> <p>Soft-bodied, slow-moving, pale-yellow-green to black winged and wingless insects often feeding in colonies are usually on underside of leaves.</p> <p>Tiny, almost invisible, 8-legged creatures, cause considerable fine webbing on under side of leaves, and leaves are whitish to reddish brown; usually starts along the edge of the field or in small spots.</p>	<p>Lygus bugs. See p. 15.</p> <p>False chinch bugs. See p. 15.</p> <p>Beet leafhopper. See p. 16.</p> <p>Foliage-feeding aphids. See p. 17.</p> <p>Spider mites. See p. 18.</p>

DESCRIPTIONS OF PESTS

Sugarbeet insects can be divided into three groups—those that feed on seed and roots, those that feed on leaves, and those that suck plant juices.

Those That Feed on Seed and Roots

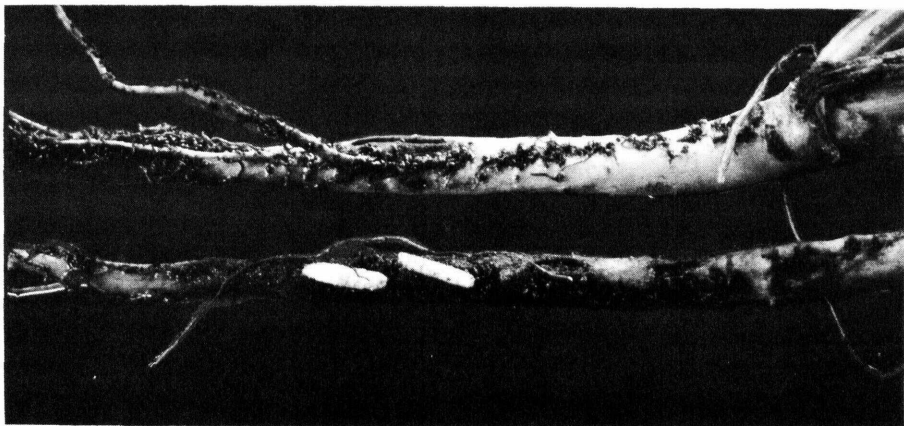
Several insects and closely related pests live in the soil and attack the germinating seed and roots of sugarbeets. Most important are the sugarbeet root maggot, wireworms, white grubs, and symphylans. Additional information on insects affecting sugarbeets grown for seed is provided in USDA Agriculture Handbook No. 253.

The *sugarbeet root maggot* is the larval stage of a shiny-black fly about one-fourth inch long. Its transparent wings have a small dark area on the front margins one-third of the distance from the base of the wing.

The adults lay slender, white, slightly curved eggs one-fourth inch under the soil surface around the beets. The eggs hatch in a few days into white maggots without legs, eyes, or distinct heads. These maggots are larger at the rear, taper like a horn, and come to a sharp point at the front (fig. 1).

When full grown, the maggots are about one-fourth to one-third inch long, tough skinned, and firm to the touch; it is in this stage that they pass the winter. The maggots are found on roots of wilting or dying beets (fig. 2). They feed by rasping the beet root, often cutting off the tap and feeder roots. Sometimes 80 to 90 percent of the beets are killed.

Wireworms may be found feeding on beet roots. These hard, wire-like worms (fig. 3) are the young of several species of slender, hard-shelled, tan to dark-brown beetles



TF 561

Figure 1.—Young sugarbeet roots showing root maggots and damage they cause. Note the scarred tissue.

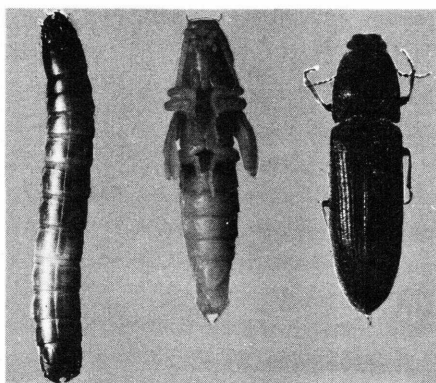


TF 561A

Figure 2.—Roots of young wilted beets pulled to show the maggots feeding on them.

that are one-third to one-half inch long.

These beetles often are referred to as click beetles or snapping beetles, because of their habit of snapping the forepart of the body to right themselves when on their back or when held between the fingers. The female beetle lays 200 to 500 pearly white eggs in the soil. Eggs hatch in about 2 weeks. The newly hatched larvae are pure white and have dark jaws; they turn yellowish to dark brown with age. Newly hatched larvae are one-sixteenth



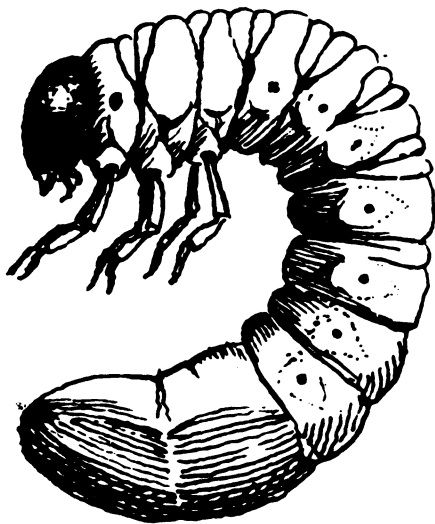
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Figure 3.—Stages of the sugarbeet wireworm: Left to right, full-grown larva, pupa, adult beetle.

inch long; full-grown larvae may be 1½ inches long. They live in the soil 2 to 6 years before pupating and changing to adults.

Wireworms may reduce plant stands by destroying seed during germination or tiny plants soon after they emerge. In midseason, they cause plants to wilt by cutting off the taproots, which reduces yields. Older roots are not so severely damaged by their feeding, but root-rotting organisms may enter wounds and cause heavy losses.

White grubs are the larvae of June beetles. These soft, robust, dirty-white to grayish, U-shaped grubs (fig. 4) have six legs, shiny-brown heads, and enlarged blackish abdomens, or hind parts. The grubs vary in length from ⅛ to 1½ inches. They live 1 to 4 years in the soil, the length of time depending on the species, and then



C&F 2526

Figure 4.—White grub.

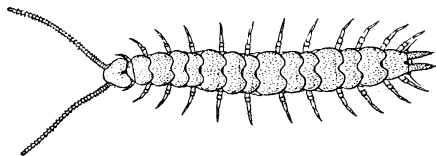
pupate and emerge as beetles during May and June.

The adults are sluggish, hard-shelled, brown, robust beetles that are one-half to three-fourths inch long. They fly clumsily about early in the evening and feed at night on the foliage of many plants.

The grubs feed on the roots of beets, often cutting off the taproots just after thinning, which causes the beet plants to wilt and sometimes die. This insect prefers grass and pasture land for egg laying and grub development, so sugarbeets should not be planted on newly plowed land.

Garden symphylans are active, small, fragile, whitish, centipede-like creatures (fig. 5) that inhabit the soil. Newly hatched larvae are white and have six pairs of legs, but they become darker as they grow older. Each time they molt, they add an additional pair of legs until they have 12 or more. Adults have 15 body segments, well-developed antennae, and chewing mouthparts. They are about one-fourth inch long.

Adults move about in the soil through cracks and earthworm holes, feeding on the roots of plants. All stages may be found at the same time. They are difficult to control, because only about 35 per-



EPQ 2005

Figure 5.—Symphylan.

cent of the total population can be found in the upper 6 inches of soil at any one time.

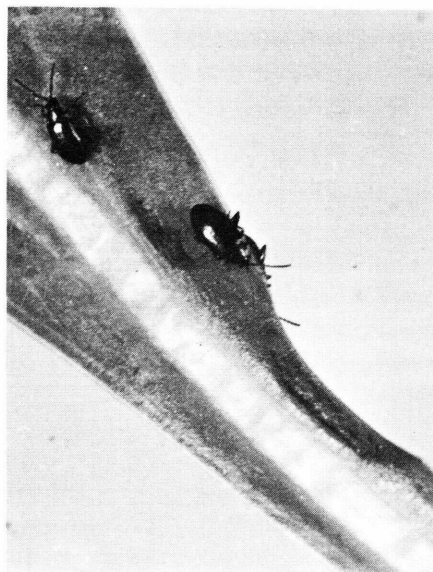
Those That Feed on Leaves

More sugarbeet pests feed on foliage than on roots. One or another of these pests feed on the foliage from the time seed sprouts until harvest. Most important of the chewing insects are flea beetles, cutworms, the sugarbeet crown borer, webworms, the spinach leaf miner, armyworms, the alfalfa looper, grasshoppers, blister beetles, carrion beetles, and the salt-marsh caterpillar.

Flea beetles are tiny, brown to shiny-black or striped, jumping beetles (fig. 6). Adults range from one-sixteenth to one-fifth inch long. They may feed on emerging plants under the soil surface, but usually they feed on the cotyledon and first true leaves, causing a shothole appearance. Heavy infestations may kill the plants.

Most beetles overwinter as adults under leaves or other plant residue along fence rows and ditchbanks, although some species overwinter in the soil. These beetles emerge on the first warm days of spring and feed on almost any green plant, from which they migrate to beetfields. Often, this migration starts before the beets are up. They do most damage in cold springs when the beets grow slowly.

Cutworms all have similar feeding habits. Several varieties found on sugarbeets feed at night on the beet plants, at or just below the soil surface, and rest in the daytime



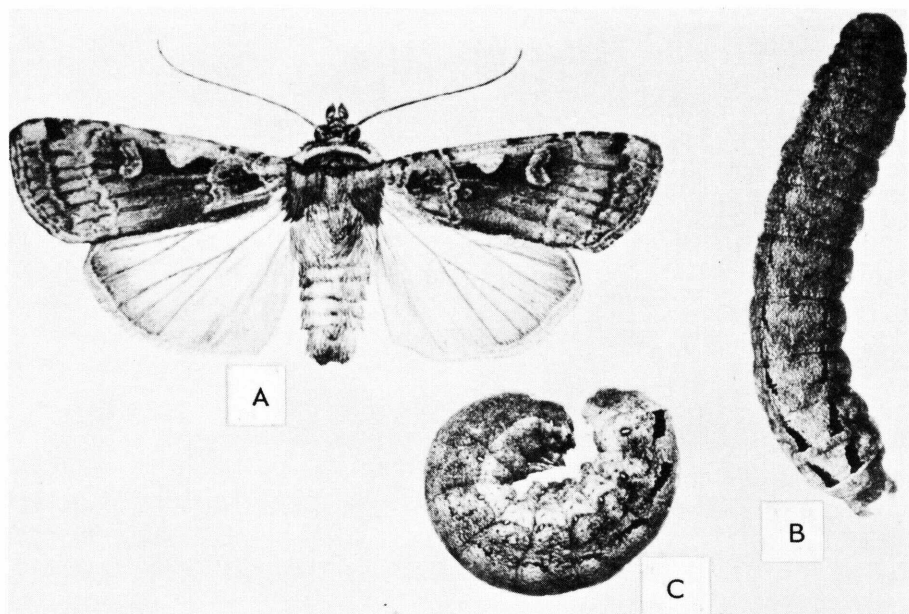
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Figure 6.—Black flea beetles feeding on sugarbeet leaf.

in a curled-up position just below the soil surface near the plant on which they had recently fed. The first evidence of injury is the freshly cut, wilted tops of beets.

The larvae (fig. 7) are smooth, hairless, fat, soft bodied, and greasy looking. They remain motionless when disturbed. Their color varies from gray or reddish to almost black. Full-grown larvae may be 2 inches long. They pupate in the soil and emerge as medium-sized, dusky-brown or gray moths that fly at night and lay their eggs in loose soil.

The most important sugarbeet cutworms are the army, black, spotted, glassy, pale western, red-backed, and variegated cutworms. They usually do most damage in beetfields that follow pasture, alfalfa, or clover crops.



TC 3668

Figure 7.—The spotted cutworm: A, Adult; B and C, larvae.

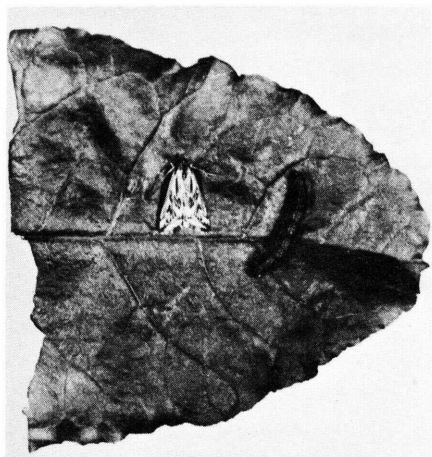
The *sugarbeet crown borer* may damage beets about thinning time, or soon after. The dirty-white larvae have a distinct greenish tinge. They are found in silken tubes 2 to 6 inches long radiating out from the beet crown just under the soil surface. The larvae remain in the tubes during the day and emerge at night to feed on beet crowns, often cutting them off. The tubes often can be removed with the larvae inside. When disturbed, they throw themselves about violently and can move forward or backward with equal ease.

Full-grown larvae are three-fourths inch long. Running lengthwise of the body in the middle of the back is a reddish-brown, broken line; on each side are four broken

lines of the same color, but paler. Several dark spots are on each segment, each bearing a fine bristle.

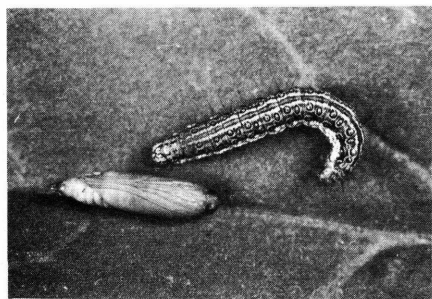
Two or more generations occur a year, the first doing the most damage. They overwinter in the pupa stage in the soil and emerge in the late spring as small, dark-gray moths that have a wingspread of about three-fourths inch. The forewings have two characteristic undulating, transverse white lines near the outer margin, and have a red spot usually located near the base.

Webworms usually attack sugarbeets around midseason. The most important of several species are the beet webworm (figs. 8 and 9) and the garden webworm (figs. 10 and 11). They are voracious feeders,



TC 7365

Figure 8.—Beet webworm adult moth and larva on beet leaf.



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Figure 9.—Full-grown beetle webworm and pupa.

causing considerable damage to the beet foliage in a few days.

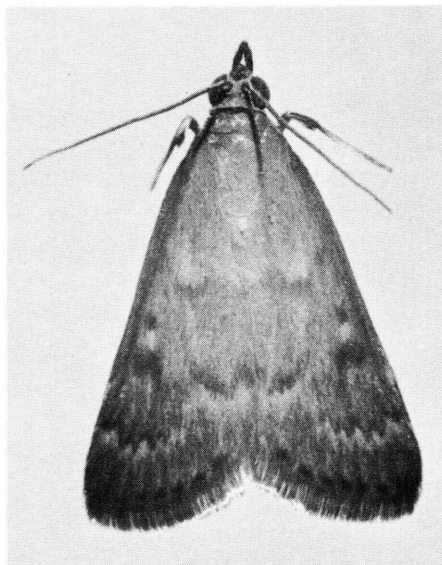
The newly hatched beetle webworms are cream colored and about one-sixteenth inch long. They turn dark green in a few days. They feed mostly on the underside of the leaves. When disturbed, the webworms drop and hang on fine threads.

Full-grown webworms are olive green, and have light and dark longitudinal stripes running the

length of the body. At first, they eat small patches from the underside of the leaves, but seldom eat through. As they grow larger, webworms eat the foliage, leaving only the leaf veins (fig. 12).

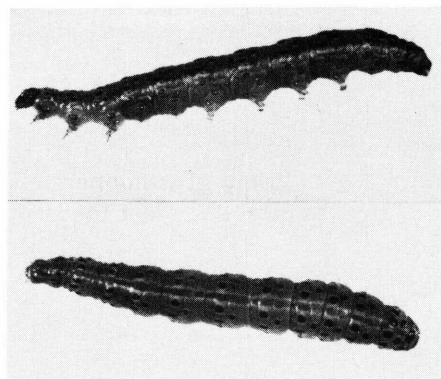
They pupate in the soil and emerge as grayish-brown moths about 1 inch across. At rest, they are triangular in shape. When disturbed during the day, they make short, rapid, zigzag flights and alight on some hidden part of the foliage.

The garden webworm color varies from pale and greenish yellow to dark yellow. It is slightly hairy and has numerous black dots. It does more web spinning than the beetle webworm. Otherwise, the habits are similar. The moth of this species is reddish brown to dark gray, and it is a little smaller than the beetle webworm. Both species



TC 7458

Figure 10.—Moth, or adult, of the garden webworm.



TC 7460

Figure 11.—Full-grown garden webworm larvae.

fly at night and may be attracted to lights in large numbers. The garden webworm spins a silken tube within which it remains most of the time, thus making control more difficult.

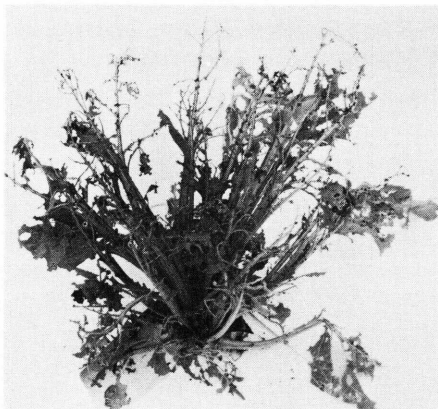
The *spinach leaf miner* is another early to midseason beet pest. Since this is a small insect, living between the lower and upper surfaces of the leaves, it does not ordinarily cause serious damage. At first, the winding mines appear as whitish or brownish lines, but as the maggots grow they form large irregular-shaped blotches or blisters. Loss of foliage from heavy infestations may retard growth of the plant and reduce yield. When mature, maggots drop to the ground and pupate in the last larval skin, which is known as the puparium. Adults emerge as slender, gray flies; the front of the head is silvery white. Several generations occur in a year, and they overwinter in puparia under trash and in the soil.

Armyworms are any of several species of thick-bodied caterpillars

that crawl over the ground in masses, consuming all green plants in their path. The most common species attacking sugarbeets are the beet armyworm, fall armyworm, yellow-striped armyworm, zebra caterpillar, and the army cutworm.

Armyworms belong to the same family as cutworms; the adults are heavy-bodied, night-flying moths, or millers (fig. 13), that are attracted to lights. They have a wingspread of about $1\frac{1}{2}$ inches. The color of the different kinds of moths varies from a dark-gray ground color through grayish to reddish brown. The forewings are generally marked with darker bands and spots, which give a mottled appearance. Full-grown armyworms are nearly naked, smooth, striped caterpillars about $1\frac{1}{2}$ inches long (fig. 14).

The *alfalfa looper* is primarily an alfalfa and clover feeder, but it often migrates to beets planted adja-



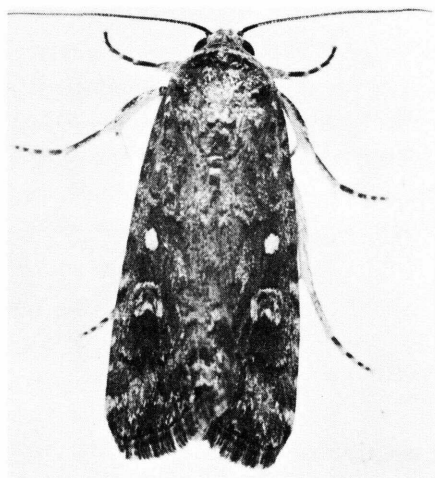
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Figure 12.—Single beet plant severely damaged by beet webworm attack.

cent to such fields after the hay has been cut. It causes serious foliage damage in a short period of time.

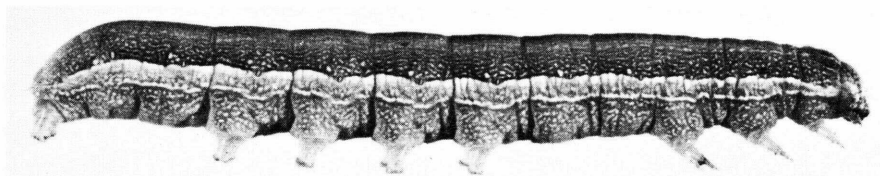
Young loopers are light green, but turn dark olive green to pale greenish brown. They taper toward the head. They have two pairs of abdominal legs just back of the middle and one pair at the rear end, allowing them to crawl in a looping manner.

When full grown, loopers are 1 to 1½ inches long. At this stage, they tie several leaves together, in which they spin loose white cocoons. These transform into adult moths in about 10 days; two or more generations occur each year.



TC 7454

Figure 13.—Moth of the beet armyworm.



TC 7456

Figure 14.—Full-grown larva of the beet armyworm.

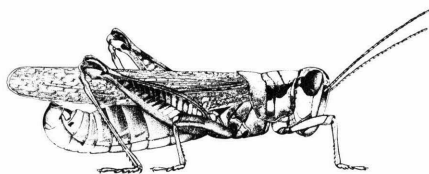
Grasshoppers (fig. 15) are common pests of cultivated crops and occasionally injure sugarbeets, especially in late summer or early fall when other crops are maturing and the migrant grasshoppers are looking for more succulent food. In some areas, greatest injury occurs in late spring or early summer.

Several species of grasshoppers feed on sugarbeets; examples are the clear-winged, differential, lesser migratory, red-legged, and two-striped grasshoppers. All have about the same life history.

Only one generation occurs in a year. In late summer and early fall, females lay eggs in the soil at depths up to 3 inches along ditch-banks, fence rows, or waste areas. They do not use barren land, such as summer fallow, or irrigated and cultivated fields for egg laying. Eggs hatch in April, May, and June, the time varying with the weather and the species; and the grasshoppers feed for 60 to 90 days.

Blister beetles of several species are general feeders and occasionally attack sugarbeets. The most important species are the ash-gray, black, margined, spotted, and striped blister beetles.

They are slender beetles about four times as long as wide, have conspicuous heads and necks, long legs



C&F 4610

Figure 15.—The red-legged grasshopper.

and antennae, and rather soft wing covers, which do not completely cover the tip of the abdomen (fig. 16). They may invade sugarbeet fields by either flying or crawling. Often, they swarm into beetfields and strip the plants of their leaves in a very short time, then depart as suddenly as they came.

The adult beetle is the only harmful stage of this insect. The females lay 50 to 300 eggs in cavities in the ground. The eggs hatch into larvae that feed mostly on grasshopper eggs.

Carion beetles of two similar species feed on sugarbeets. The adult is a uniformly dull black, oblong-oval-shaped beetle (fig. 17) having elevated ridges running lengthwise on its wing covers.

About thinning time, the beetles emerge from overwintering quarters along field margins, ditchbanks, roadsides, and waste areas, enter the beetfields, and feed on the small plants. Soon after they begin feeding, females lay their eggs in the soil. The eggs hatch in 5 days, and the young larvae emerge and start feeding on the beets.

When full grown, the larvae are shiny black, flat, and wedge shaped, and have distinct body segments. When present in large numbers, carion beetles can do a great deal of damage in a few days. In 3 to 4 weeks after hatching, the larvae enter the soil and pupate. They overwinter as adults in the soil.

The *salt-marsh caterpillar* larva belongs to the group known as woolly bears. They are 1½ to 2 inches long when full grown. Their bodies are partly covered by long reddish-brown or black hairs that give them a woolly appearance (fig. 18). Their sides are distinctly marked with yellowish spots forming two broken lines.



TF 771

Figure 16.—Ash-gray blister beetles on sugarbeets.



TF 659

Figure 17.—Carrion beetle.

They are general feeders, attacking many crops, including sugarbeets. They usually do not become numerous enough to cause much damage until late summer.

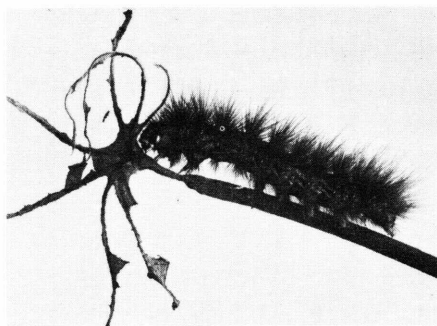
The salt-marsh caterpillar is the larva of a large, robust, white moth that has a wingspread of $2\frac{1}{4}$ to $2\frac{1}{2}$ inches. Both wings are white in the female, hindwings are orange in the male, and wing surfaces are marked with black dots (fig. 19). The abdomen is orange yellow, marked with a row of six black spots down the middle of the back.

The moths appear in late spring. Females lay round, pale-yellow eggs in large masses on the underside of food plant leaves. The eggs hatch in 4 or 5 days; the caterpillars mature in a month and spin thin, brownish cocoons, interwoven with their hair, under trash and dead leaves where they overwinter. One or more generations occur in a year, the number depending on the area.

Those That Suck Plant Juices

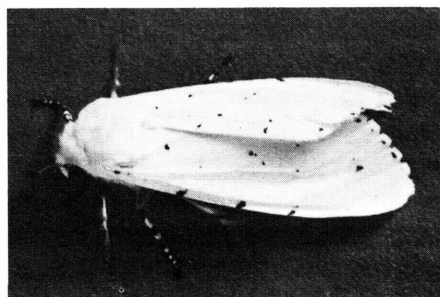
Many insect pests feed on sugarbeets by inserting their needlelike beaks into the tissue and sucking out the plant juices. The most important are the sugarbeet root aphid, lygus bugs, the false chinch bug, the leafhopper, and foliage-feeding aphids. Mites, which belong to the same class as the spider, also feed on the plant juices.

The *sugarbeet root aphid* is a pale yellowish insect found on the roots surrounded by a white moldlike substance. During the summer, adults are all wingless females that give birth to living young, which mature



TC 7274C

Figure 18.—Salt-marsh caterpillar.



TC 7274A

Figure 19.—Adult, or moth, of the salt-marsh caterpillar.

in a couple of weeks. Several generations are produced on the sugarbeet roots each season, and aphids may be found in all sizes up to one-eighth inch long.

In the fall, winged males and females are produced. After mating, females lay eggs on cottonwood and poplar trees, on which they overwinter. This insect also passes the winter as adults on roots of sugarbeets, lettuce, dock, lambs-quarter, and other plants.

The sugarbeet root aphid feeds by sucking sap from the roots. This causes leaves to become light or yellowish green, wilt, and often die. Infested beets are usually short and have many hair roots.

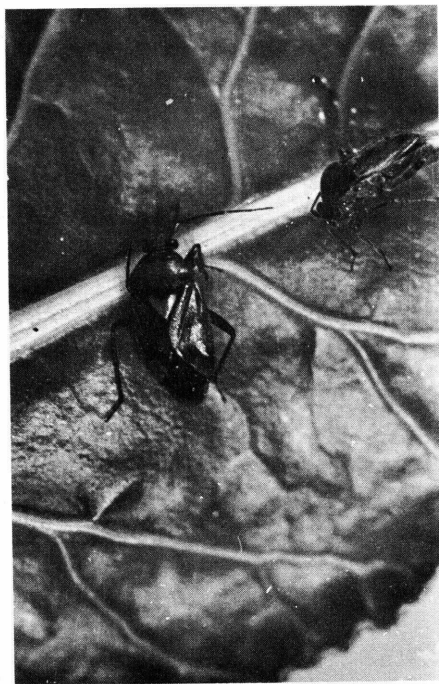
Lygus bugs are primarily seed feeders and, therefore, do not remain long in fields of beets grown for sugar. The three species of lygus bugs that infest beets bear a general resemblance to each other in shape, size, and color. The body is flattish, varying from five thirty-seconds to three-sixteenths inch long and about one-half as wide (fig. 20). Body colors vary in different species from pale green to reddish or dark brown.

In cold areas, lygus bugs overwinter as adults in grass clumps, under leaves and other trash along ditchbanks and fence rows, or in any place they can get protection. They are among the first insects to become active during warm days in early spring. In southern areas, they are active through the winter months. Eggs laid in the green plants soon hatch into nymphs, which somewhat resemble the

adults. Several generations occur in a year.

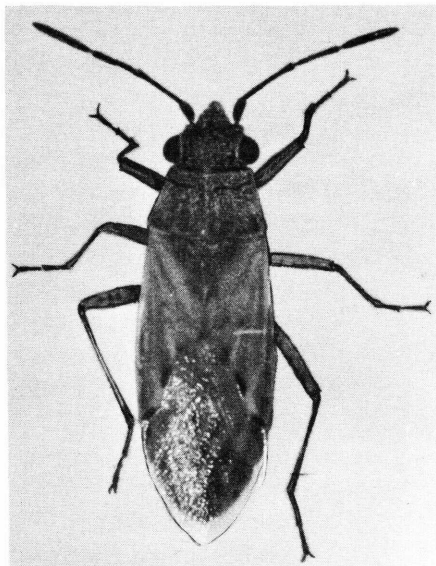
The adults move in and out of beetfields in early spring and after each cutting of hay. Their feeding seems to be toxic, and wherever they insert their needlelike beaks, the plants bleed profusely and the cells for some distance around are killed. This later causes cavities or distorted growth.

The *false chinch bug* (fig. 21), very similar to the true chinch bug, is a grayish-brown, narrow-bodied insect about one-eighth inch long. It overwinters in litter along ditchbanks and fence rows and in waste areas as an adult or a dull-gray nymph, emerging in early spring to



TF FILMSTRIP 1

Figure 20.—Lygus bug.



TC 7476

Figure 21.—False chinch bug.

feed mostly on early-maturing weed hosts.

Like the beet leafhopper, this bug is a strong flier as an adult and moves to more succulent plants when the weed hosts start maturing. It is during this movement that false chinch bugs infest sugarbeets and other plants. They usually congregate in masses, and their feeding causes the beets to wilt and die in a short time.

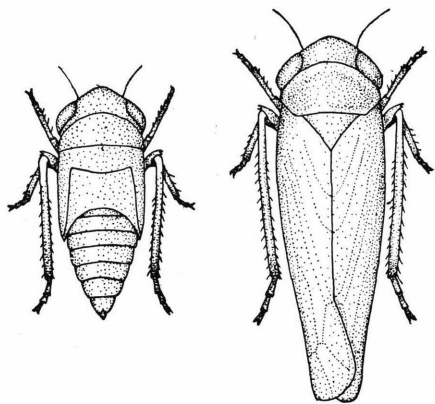
The *beet leafhopper* (fig. 22) is an active, sun-loving, dry-climate insect. It is wedge shaped, about one-eighth inch long, and varies in color from light yellowish green in the summer to grayish brown in the fall. In flight it appears white and has been nicknamed the "whitefly."

The beet leafhopper overwinters mostly as fertilized females in desert and waste areas and feeds on

mustards and other plants that germinate in the fall.

Eggs are laid inside the leaf and stem tissues of these plants. They hatch into tiny white nymphs, which turn darker and become spotted with red and brown giving the appearance of a saddle as they become older. These nymphs develop wings about the time spring annual plants become mature, and winged adults move in search of more succulent plants, such as Russian-thistle, where they breed during the summer. In late summer and fall, they return to desert and waste areas when the summer hosts start maturing. It is during the spring movements that they infest sugarbeets and other cultivated crops.

The beet leafhopper seldom becomes numerous enough to cause damage by direct feeding, but it carries a virus that it transmits to plants, causing curly-top disease. The younger the plants at time of the movement, the more susceptible



TF 366

Figure 22.—Beet leafhopper nymph and adult.

they are to the disease. Even curly-top-resistant varieties are susceptible in early stages of development. Consequently, the amount of damage the insects cause depends on the time they move, the magnitude, the duration of the movement, and the percentage carrying the virus. This virus overwinters in both the leafhopper and its host plants, and the percentage varies from year to year.

Some leafhoppers feed and lay eggs on mustards and Russian thistle growing on wastelands within cultivated areas. Thus, in

localized areas much can be done on a community basis by adopting practices that will lead to the replacement of weed hosts by perennial grasses, which are not breeding hosts of the insect.

Foliage-feeding aphids are soft-bodied, slow-moving, small insects about one-sixteenth inch long. They have long antennae and legs. Seen from above, they appear somewhat egg shaped, the head being at the small end (fig. 23). Two cornicles resembling exhaust pipes extend up but mostly back from the rear end. Both winged and wing-



TF FILMSTRIP 1

Figure 23.—Green peach aphids on sugarbeet leaf.

less forms occur. When folded over the back, the wings are roof shaped.

During the summer months, all the adults are females, and they give birth to living young, which themselves give birth to living young in 2 weeks. Consequently, they build up large populations in a short time unless checked by their natural enemies or insecticides.

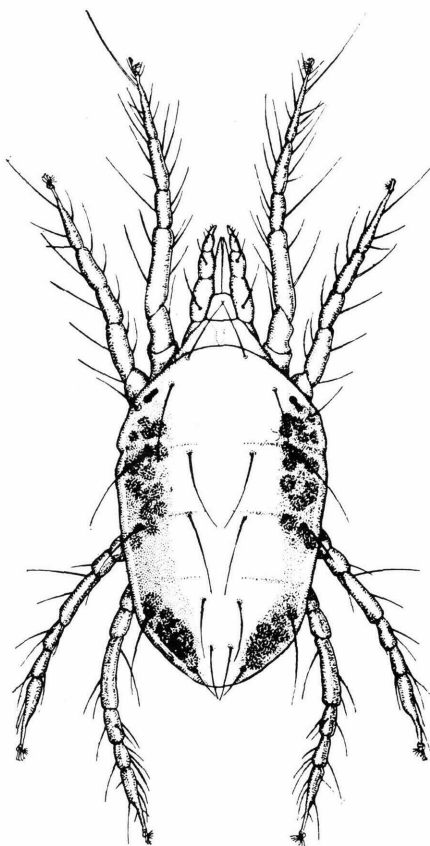
In addition to the considerable damage done by large numbers of aphids sucking out the plant juices, they also transmit viruses of two destructive yellows diseases to sugarbeets. The winged forms spread the disease more widely than do the wingless ones. Of several aphids that feed on beets, the green peach aphid and the bean aphid are the two most important.

Examine fields closely for insect predators and parasites, as well as for evidence of fungus diseases. Often, natural enemies will control an aphid infestation without the use of insecticides. If aphids are numerous and natural enemies are

scarce, do not hesitate to apply insecticides.

Mites are tiny spiderlike pests (fig. 24) that overwinter in the soil, in trash, on weeds, and in alfalfa and clover fields. In early spring, they migrate by crawling or by being blown by the wind to growing plants. A complete life cycle may be passed in 2 to 3 weeks. Thus, they have many generations each year and can build up large populations in a short time.

Infestations are usually spotted,



TC 7278

Figure 24.—Adult of the two-spotted spider mite.

Rotation and sanitation are good preventive measures. Continued growth of beets on the same piece of land breeds many sugarbeet pests.

Destroy weeds growing on waste and idle land within and adjoining cultivated fields, as well as those growing in the beetfields themselves. Weeds are preferred hosts of many insects; these insects move onto beets when weeds begin maturing.

mostly along the edge of the field, and can be recognized by the whitish or yellowish appearance of the plants, which often turn reddish

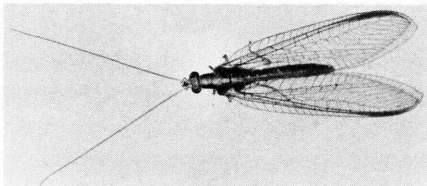
brown. If you look closely, you can see tiny spiders and webbing, usually on the undersides of the leaves.

BENEFICIAL INSECTS

Many insects are beneficial to man. Some pollinate our fruit and seed crops, some furnish us with foods, and others destroy harmful insects. Some of the beneficial insects found in beetfields are described below.

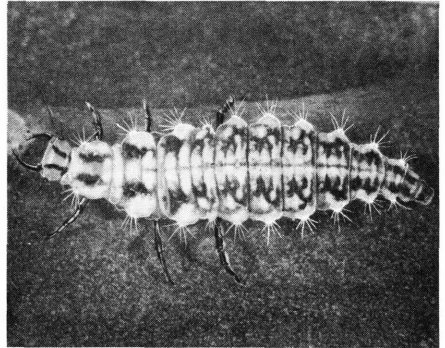
Aphid lion adults, about five-eighths inch long, are fragile, delicate, light-green insects. They have hairlike antennae and four lacy wings that fold rooflike over the body when at rest (fig. 25). The young are more robust, rather elongated, and tapered at both ends. They are yellowish or mottled with brown, and have large sickle-shaped jaws for grasping prey and sucking out the body fluids (fig. 26). They are important predators of aphids and related insects.

Lady beetle adults are oval-shaped, shiny, yellow to orange, and usually have black spots (fig. 27). Young are black or gray and have some orange or reddish markings. They resemble miniature alligators (fig. 28). Both adults and larvae



TC 7483

Figure 25.—Green lacewing, or aphid lion.



TC 7485

Figure 26.—Larva of green lacewing sucking the body fluids from an aphid.

feed on aphids, spider mites, insect eggs, and other small insects.

Assassin bugs are light brown to gray, are one-half to three-fourths inch long, and have wings lying flat on the back. They have rather long legs; their forelegs are strong and they use them for grasping and holding their prey while they suck out the body fluids (fig. 29). They feed on many different kinds of insects.

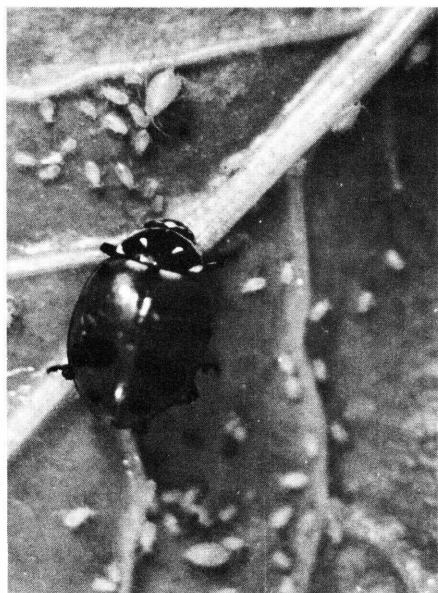
Damsel bugs resemble assassin bugs, but are much more slender. They are pale and gray, about three-eighths inch long. They also feed on many insects by sucking out the body fluids.

Flower bug or *pirate bug* adults are about one-sixteenth inch long,

flat, and oval shaped (fig. 30). They are black and have white spots. The young (nymphs) are shaped like adults, but are amber colored (fig. 31). Both adults and nymphs feed on spider mites and their eggs and other small insects.

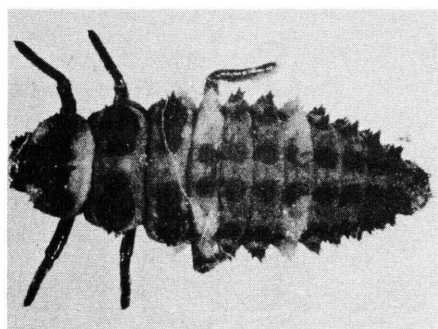
Syrphid flies, bright yellow and black beelike flies, about one-fourth

inch long, are often seen hovering over beet plants looking for insect infestations where they can deposit their eggs. The eggs hatch in a short time, and the young maggots, pointed at one end, probe blindly



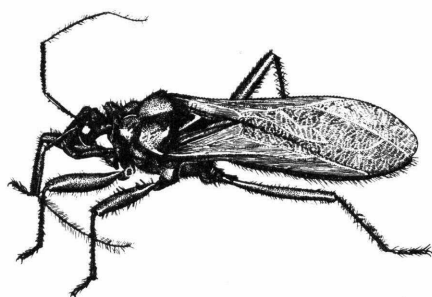
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Figure 27.—Lady beetle feeding on aphids.



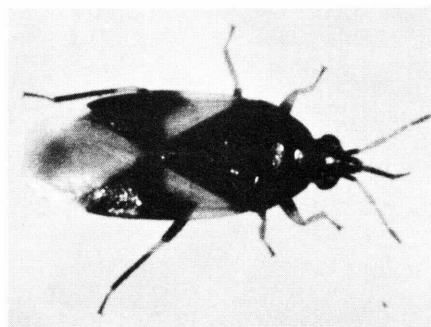
TC 7481

Figure 28.—Larva of lady beetle.



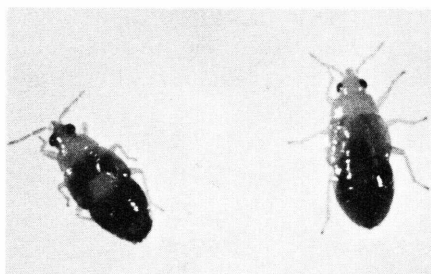
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Figure 29.—Assassin bug.



TC 7472

Figure 30.—Minute pirate bug.



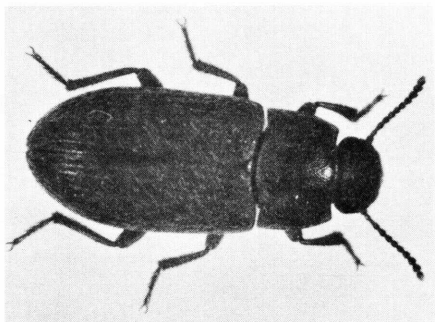
TC 7473

Figure 31.—Nymphs of the minute pirate bug.

about for insects on which they feed. They prefer aphids but feed on many other insects.

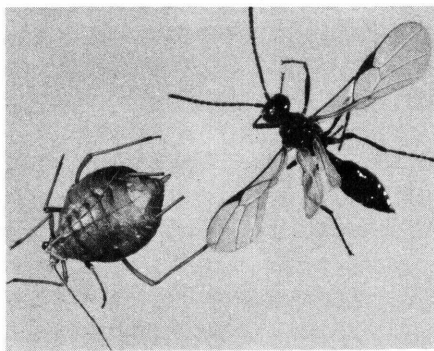
Ground beetles are blackish, long-legged beetles, broadly oval and flattened dorsally (fig. 32). They live in the ground, emerging at night to feed on many insects.

Wasps include many parasitic species that live on other insects. Tiny wasps parasitize insect eggs, larger ones parasitize small insects (fig. 33), such as aphids, and others live on worms and caterpillars.



TC 7471

Figure 32.—Ground beetle.



TC 7508, TC 7507

Figure 33.—Parasite of the green peach aphid: Top, Parasitic wasp and parasitized aphid; Bottom, aphid bodies from which adult parasitic wasps have emerged.

CHEMICAL CONTROL

Much of the time, natural enemies of sugarbeet pests keep them under control. However, at times the pest insects increase to the point that it becomes necessary to apply insecticides.

Insecticides generally are applied as granules, dusts, liquid sprays, or fumigants.

Granules and dusts are purchased ready to apply. Fumigants are purchased in liquid form ready to apply. Liquid sprays must be prepared by mixing water with dry

powder (wetttable or soluble) or with liquid concentrate (suspension or emulsifiable).

Equipment to apply insecticides ranges from hand dusters and sprayers to aircraft.

Before purchasing or using any insecticide, read the precautions to be taken in using it and be prepared to follow them.

To get full benefit from application of insecticides, observe the following principles:

Effective timing.—Apply materials before damage is excessive and while the pests are young.

Wise choice of material.—Use recommended materials and follow label directions. Residue tolerance is important and has been considered in making the recommendations.

Careful mixing of sprays.—Follow recommendations and use enough, but not more. When you use wettable powders in sprays, constantly agitate them to keep the toxicant from settling to the bottom.

Controlled dosage.—Use recommended dosage and make sure to distribute insecticide evenly over the field. Excessive dosages are wasteful and may be harmful.

Directed application. — Apply material to that part of the plant where the pest is feeding or where it is most likely to come in contact with the insecticide. For cutworms, broadcast material; for foliage feeders, apply it to the foliage; for spider mites, apply to the underside of the leaves.

Patient checking. — Constantly watch the crop. Many pests appear and do their damage in a short time. Some are difficult to detect. Natural enemies of some insects will, at times, do a better job than chemicals. You may or may not need to repeat insecticide applications. Some pests do not feed all the time, so it may take a day or so after treatment before chemicals will reduce the numbers of insects.

Applying Insecticide

Hand Equipment

Hand equipment can be used effectively for treating small spot infestations of such pests as blister beetles, spider mites, carrion beetles, and false chinch bugs before they spread. Use hand sprayers or dusters for applying insecticides in bands or barriers against migrating insects such as the alfalfa looper.

Ground Dusters

Equip ground dusters with at least one nozzle per row, set to direct the flow of dust at a 45° angle down through the plants. If you use two nozzles, set them to direct the flow of dust at the row from each side at a 45° angle. Dusters equipped with a 20-foot canvas trailer can be used at higher wind velocities, and they confine the dusts more effectively to the plants.

Ground Sprayers

Three types of sprayers used in treating sugarbeets are low-gallage and high-gallage sprayers and mist blowers. Because sugarbeet foliage is smooth, sprays usually stick better than dusts. They also are preferred by some growers because they can be applied under more adverse conditions. However, with proper adjustments, dusters give better coverage for underleaf feeders.

Low-gallage or low-pressure sprayers apply 20 to 30 gallons of spray per acre. They are simple, cheap, and easy to operate. Several sprayers of this type have

Guide for Selection and Use of Insecticides ¹

Insect	Insecticide	Formulation	Dosage per acre (active ingredient)	When and how to apply
Alfalfa looper	Carbaryl	Dust or spray	<i>Pounds</i> 1.0	Apply when worms get into field. Treat areas infested.
	Trichlorfon or	Spray	1.5	
	Parathion	Dust or spray	.5	
Aphids: On beet roots ²	Parathion or	Dust or spray	.5	Prevent serious losses by crop rotation, fall plowing, and other good cultural practices. Apply as soon as aphids become numerous, if natural enemies are scarce. Do not apply demeton more than 3 times during the season.
	Tepp or	Spray	.4	
	Phosphamidon or	Spray	1.0	
On beet foliage	Demeton or	Spray	.5	Apply to infested area.
	Disulfoton or	Granules	1.0	
	Trichlorfon or	Spray	1.5	
Armyworms	Parathion or	Dust or spray	.5	Apply when beetles appear.
	Carbaryl or	Spray	1.0	
	Parathion or	Dust or spray	.5	
Blister beetles	Parathion or	Dust or spray	.5	Apply when beetles cause damage.
	Trichlorfon or	Spray	1.5	
	Phosphamidon or	Spray	1.0	
Carrion beetles Cutworms	Parathion or	Dust or spray	.5	Apply to rows of beets when damage occurs.
	Carbaryl	Spray	2.0	
	Phosphamidon or	Spray	2.0	
Flea beetles	Parathion or	Dust or spray	.5	Apply when beetles appear and concentrate on beets.
	Carbaryl	Spray	2.0	
	Phosphamidon or	Spray	2.0	

False chinch bug	Parathion	Dust or spray	. 5	Apply when they become numerous on plants. Usually appear in small spots.
Garden symphytan	Parathion	Dust or spray	5. 0	Apply to soil before planting, and thoroughly work into first 6 inches of soil.
Grasshoppers	Malathion or Carbaryl	Dust or spray	2. 0	Apply to borders when grasshoppers appear, and treat infested portion of the field.
Leaf miners	Trichlorfon	Spray	1. 0	
	or	Spray	1. 0	Apply as soon as mines appear in the beet leaves.
Lygus bugs	Parathion	Dust or spray	. 5	
	or	Dust or spray	. 5	Apply to foliage as needed.
	Trichlorfon	Spray	1. 0	
	or	Spray	1. 0	
Root maggot ³	Naled	Spray		
Salt-marsh caterpillar	Trichlorfon	Spray	1. 5	
Spider mites	Sulfur	Dust	30. 0	Apply to infested areas. Do.
	or			
Sugarbeet crown borer ³	Carbophenothion	Dust	1. 0	
Webworms	Trichlorfon	Spray	1. 5	Apply as soon as damage shows.
	or			
	Parathion	Dust or spray	. 5	
	or			
White grubs	Phosphamidon	Spray	1. 0	Broadcast on soil and immediately work into first 6 to 9 inches. Avoid planting beets in soil that was in grass, pasture, or alfalfa the previous year.
	Parathion	Granules	4. 0	Broadcast on soil surface, and immediately work into top 6 to 9 inches. Soil temperature should be at least 50° F.
Wireworms	Parathion	Granules	4. 0	
	or			
	Diazinon	Granules	3. 0 to 4. 0	

¹ Mention of a proprietary product in this publication does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture and does not imply its approval by the Department to the exclusion of other products that may also be suitable.

² No satisfactory chemical control.

³ No satisfactory control.

pumps that are attached to the tractor power takeoff. Emulsion sprays are most satisfactory to use with this type of sprayer.

High-gallonage or high-pressure sprayers apply 100 or more gallons per acre and operate with a cylinder hydraulic pump that can maintain pressures up to 600 pounds or more per square inch. They are more complicated than low-gallonage sprayers and are more expensive and difficult to operate. They require more water and are heavier, which is a factor to consider in treating irrigated fields.

Mist blowers apply 1 to 6 gallons per acre. Concentrated insecticides are pumped under pressure into a high-velocity airstream that further breaks the spray into minute droplets. These droplets are blown into the foliage where they are deposited. This type of spray has worked well on many sugarbeet insects. Mist blowers are fast, cause less damage to the field, and can be used under rather adverse conditions.

Spray booms should be made to cover 4 to 12 rows and built so they can be raised or lowered, as well as folded for transportation. Equip the boom with good spray nozzles, and keep them clean. If no provision is made for an agitator, use emulsion sprays and stir these quite often.

Aircraft Application

More and more chemicals are being applied by aircraft. It is much faster than other means, causes no mechanical injury to the

plants, and wet, irrigated fields are no problem. However, aircraft application usually is not as effective as ground equipment when treating for pests that feed under the leaves or deep in the center of the foliage. If dosages are increased, be certain not to exceed maximum amounts per acre indicated on the label.

Precautions

Insecticides used improperly may be injurious to man and animals. Use them only when needed and handle them with care. Follow the directions and heed all precautions on the labels.

Keep insecticides in closed, well-labeled containers in a dry place. Store them where they will not contaminate food or feed, and where children and pets cannot reach them.

Avoid repeated or prolonged contact of insecticide with the skin. Avoid prolonged inhalation of insecticide dusts or mists.

When handling insecticides, wear clean, dry clothing.

Wash your hands and face before eating or smoking and immediately after applying insecticide.

Many insecticides, such as carbaryl, sulfur, malathion, and trichlorfon can be used safely without special protective clothing or devices, providing they are in dilute dusts or water sprays. However, most concentrates and oil solutions require special precautions. When handling or mixing a concentrate of any insecticide, avoid spilling it on the skin, and keep it out of the eyes,

nose, and mouth. If any is spilled, wash it off the skin and change clothing immediately. If it gets in the eyes, flush with plenty of water for 15 minutes and get medical attention.

Some insecticides, such as diazinon and naled can be absorbed directly through the skin in harmful quantities. When working with these insecticides in any form, take the same precautions as with concentrates.

Carbophenothion, demeton, disulfoton, parathion, phosphamidon, and tepp are extremely poisonous and may be fatal if swallowed, inhaled, or absorbed through the skin. These highly toxic insecticides should be applied only by a person who is thoroughly familiar with their hazards and who will assume full responsibility for safe use and comply with all precautions on the labels. After applying parathion to the soil, keep all persons and animals off the treated area for 48 hours.

Use of insecticides must be discontinued a specified number of days before harvest. The following shows the number of days that must elapse between last use of insecticides and harvest:

Insecticide:	Days
Carbaryl -----	14
Carbophenothion -----	14
Demeton -----	30
Disulfoton -----	30
Malathion -----	7
Naled -----	5
Parathion -----	15
Phosphamidon -----	30
Tepp -----	3
Trichlorfon ¹ -----	28

¹ 14 days if tops are not to be used for food or feed

To protect water resources, fish, and wildlife, be careful not to contaminate streams, lakes, or ponds with insecticides. Do not clean spraying equipment or dump excess spray material near such water.

To prevent losses in nearby crops from lack of pollination, apply insecticide during hours when the honey bees and wild bees are not visiting plants. Avoid drift into bee yards and adjacent crops in bloom. Notify beekeepers at least 48 hours before dusting or spraying large acreages so that they may take measures to protect the bees.

Avoid drift of insecticides to nearby crops and livestock.

Dispose of empty insecticide containers at a sanitary land-fill dump, or bury them at least 18 inches deep in a level, isolated place where they will not contaminate water supplies.

